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Two new genera and species of Elcaninae (Orthoptera, Elcanidae) from mid-Cretaceous Burmese amber

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Abstract

Two new genera of Elcanidae Handlirsch, 1906 are described from mid-Cretaceous Burmese amber. *Adelphellca simplicissima* **gen. et sp. nov.** is based on a well-preserved forewing and metathoracic leg with leaf-like metatibial spurs. It is placed in the subfamily Elcaninae Handlirsch, 1906 due to its wing venation feature of fused 1A + CuPb + CuPaβ. The species *Probaisselcana zhengi* Gu et al., 2022 is suggested to be removed from *Probaisselcana* due to its long anal margin between CuA + CuPaα and MP and instead is placed in *Adelphellca* gen. nov. because its pterostigma without cross veins excludes it from *Pseudoprobaisselcana* Schall et al., 2025. *Kolymbelcana phantasma* **gen. et sp. nov.** is described based on an almost complete female specimen. Like *A. simplicissima*, it is placed in Elcaninae based on its wing venation, which is similar to *Adelphellca*. However, the two genera differ in the shape of their ovipositor, which is sword-shaped in *Kolymbelcana* and scythe-shaped in *Adelphellca* (based on *A. zhengi*). The new species increase the number of Elcanidae from Burmese amber to 19.

Keywords

Adelphellca, Burmite, diversity, fossil, *Kolymbelcana*

Introduction

The Elcanidae are a family of Orthopterans mostly known from the Mesozoic; however, some putative occurences have been reported in the Permian and the Paleocene (Tillyard 1918, Schubnel et al. 2020). They have an almost global distribution, with species being reported from all modern continents except Africa (Tillyard 1918, Gorochov et al. 2006, Fang et al. 2018, Tian et al. 2019, Nel and Jouault 2022). Their characterizing features include large metatibial spurs of varying morphology, both wing pairs with a long pterostigma, and a general wing morphology similar to Caelifera Ander, 1939. Other aspects of their appearance (i.e., ovipositor and antennae) suggest they be placed closer to Ensifera Chopard, 1921, making their phylogenetic placement inside Orthoptera a matter of ongoing debate (Béthoux and Nel 2002, Gorochov and Rasnitsyn 2002, Poinar et al. 2007, Penalver and Grimaldi 2010, Tian et al. 2019, Zhou et al. 2022). Two subfamilies are recognized within the Elcanidae: the Elcaninae Handlirsch, 1906, which are mainly characterized by the fusion of the forewing veins 1A + CuPb + CuPaβ, and the Archelcaninae Gorochov et al., 2006, in which these veins are not fused. The subfamily Elcaninae includes eight genera, with *Panorpidium* Westwood, 1854 being the richest in species of the family (Cigliano et al. 2024). The Archelcaninae includes eleven genera, and the remaining five genera cannot be assigned to a subfamily as of yet, likely because the part of the forewing revealing 1A + CuPb + CuPaα is missing in the available specimens (Tillyard 1918, Poinar et al. 2007, Fang et al. 2018, Heads et al. 2018, Xu et al. 2022).

Starting in 2007, several species of Elcanidae have been reported from Burmese amber (Poinar et al. 2007, Penalver and Grimaldi 2010, Heads et al. 2018, Kočárek 2020, Gu et al. 2022, Uchida 2022, Xu et al. 2022, Zhou et al. 2022, Hu and He 2023, Schall et al. 2023, Willmott et al. 2025). Burmese amber is dated to be of mid-Cretaceous age (98 Myr) (Shi et al. 2012). The Elcanidae species from this *Lagerstätte* differ from their relatives by having a longer anal margin of the forewing between CuA + CuPaα and MP (this is also found in *Minelcana* Gorochov et al., 2006, as well as some species of *Panorpidium* (Gorochov et al. 2006), yet, it is omnipresent in Burmese-amber Elcanidae (Willmott et al. 2025)) and a pterostigma without cross veins (Kočárek 2020, Gu et al. 2022, Schall et al. 2023, Willmott et al. 2025). Not all species from Burmese amber exhibit a pterostigma without cross veins (e.g., *Pseudopanorpidium maculosum* (Zhou et al., 2022) and *Pseudoprobaisselcana oculata* (Hu & He, 2023). However, it is present in large diversity in the Elcanidae fauna from Burmese amber and has not been reported from any other origin.

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In this paper, we present two new species of Elcaninae from Burmese amber. They add important knowledge to the family's overall diversity, specifically that from the amber forest.

Materials and methods

The taxonomy in this study follows the Orthoptera Species File (OSF) (https://orthoptera.speciesfile.org/, Cigliano et al. 2024). Wing venation nomenclature follows Béthoux and Nel (2002). Abbreviations: **CP** = posterior costa; **ScA, ScP** = anterior/posterior subcosta; **R** = radius; **RA, RP** = anterior/posterior radius; **MA, MP** = anterior/posterior media; **CuA, CuP** = anterior/posterior cubitus; **CuPaα** = anterior branch of first posterior cubitus; **CuPaβ** = posterior branch of first posterior cubitus; **CuPb** = second posterior cubitus; **1A** = anterior anal vein.

The amber pieces used in this study are deposited at the collection of the LIB, Hamburg (Accession numbers: GPIH07019; GPIH07020; ex coll. Martin Husemann MH_0044; MH_0045). They originate from Myanmar and were discovered in a mining site either near Tanai village or Hkamti village in the Kachin State, Myanmar. The age of the two amber sites differs by ca. 10 My. Amber from Tanai is estimated to be 98.79 ± 0.62 My old (Shi et al. 2012), amber from Hkamti is ca. 110 My old (Xing and Qiu 2020). The scientific use of amber originating from Myanmar is debated, because some mining areas (especially that of Kachin State) are subjected to severe violation of human rights (Peretti 2020). However, we argue that material already present in collections should not be ignored for scientific examination. The conflict and ethical issues surrounding amber fossils of Burmese origin is discussed in depth in Haug et al. (2020) and Peretti (2020).

Images were taken with a DUN. Inc. stacking system holding a Canon EOS 5Dsr Camera with a 65 mm lens and a magnification of 1.5×. The individual pictures were taken with a combination of VD Passport and the Capture One program (Capture One A/S, Denmark). Following this, the pictures were stacked with Zerene Stacker (Zerene Systems LLC, Washington, USA), resulting in high-resolution multilayered images. They were edited with the Photoshop CS6 Extended application by Adobe Inc. (USA). Further modifications (e.g., scale-bars) and the creation of image collections were done in Inkscape v. 1.3.2 (Inkscape Team 2024, https://inkscape.org/, last accessed on 15.06.2024). Drawings were created in GIMP v. 2.10.30 (GIMP Team, https://www.gimp.org/, last accessed on 15.06.2024). To create drawings, images were imported as a layer into GIMP, a new empty layer was created, and the image was copied from the original layer. Once sketched, drawings were printed, redrawn with PITT artist pens by Faber-Castell, and scanned to turn them back into digital versions.

Results

Taxonomy

Order Orthoptera Olivier, 1789
Superfamily Elcanoidea Handlirsch, 1906
Family Elcanidae Handlirsch, 1906
Subfamily Elcaninae Handlirsch, 1906

Genus *Adelphellca* gen. nov.
https://zoobank.org/FD83D786-0A92-4DCC-9653-B5141524C905

Type species.—*Adelphellca simplicissima* sp. nov.

Included species.—*A. simplicissima*; *A. zhengi* (Gu et al., 2022).

Etymology.—The genus' name derives from a fusion of the ancient Greek term "adelphe" (sister) and the name of an other elcanid genus, *Ellca* Kočárek, 2020. It refers to the close resemblance of the two genera, differing mainly in the metatibial spur type and forewing size.

Diagnosis of genus.—Forewing with stem of RP between MA2 and MA1. Anal margin between CuA + CuPaα and MP makes up 24% of total forewing length. Pterostigma without cross veins and with large sclerotized area (12.4% of total forewing surface area). Metatibial spurs leaf-like. Ovipositor scythe shaped.

***Adelphellca simplicissima* sp. nov.**
https://zoobank.org/6DD3BFA5-7747-4997-BEFC-F6505B3A0661
Fig. 1

Etymology.—The species name refers to the simple wing morphology of this species that lacks the patterns of coloration often found in Elcanidae.

Locality and horizon.—The specimen was included in amber found in Hkamti, Sagaing Division, Myanmar or Tanai, Kachin State Burma, Myanmar, two close amber mining locations. The amber from Hkamti is ca. 110 My and the amber from Tanai ca. 99 My old.

Holotype.—Male, deposited at the LIB Hamburg (accession number GPIH07019).

Diagnosis.—Forewing length 11.5 mm. Fusion of 1A + CuPb + CuPaβ. Two longitudinal branches between CuA + CuPaα and the stem of RP. 8 branches of RP. No additional wing markings (spots or margin) present. Metatibial spurs leaf-like. Metatibia significantly shorter than metafemur (about 20% shorter).

Description.—Male. Forewing and metathoracic leg up to metatibial spurs preserved.

***Forewing*:** Forewing fully preserved, total length of 11.5 mm. Veins 1A + CuPb + CuPaβ fused. Locality of CuA + CuPaα unsure: peculiar structure at usual site might be a deformed vein damaged during preservation. Three branches of M, MA1 with two additional terminal branches. Two branches of M (MP and MA2) between CuA + CuPaα and the stem of RP. Estimated length of anal margin between CuA + CuPaα and MP making up 24% of total wing length. RP with 8 branches. RP2, 3, 4, and 8 with secondary branching. Multiple cross veins between branches of RP and M. Pterostigma present, dark (i.e., sclerotized), and without cross veins. ScP rather broad. No wing spots or conspicuously colored wing margin present.

***Metathoracic leg*:** Metafemur and metatibia with metatibial spurs preserved, but, due to clearness of the amber piece, the details are difficult to interpret. Metafemur approximately 7.2 mm long (exact point of origin obscured). Shape standard for Elcanidae. Metatibia 5.6 mm long (based on the position of metatibial spurs, which are usually located toward the distal end of the metatibia and are completely preserved in the specimen; this is assumed to be the full length of the metatibia). Metatibial spurs leaf-like, either 2 or (more likely) 3 pairs. One short proximal and apical spur proceeding and succeeding metatibial spurs, respectively.

Remarks.—Based on its wing venation of 1A + CuPb + CuPaβ fused, the new species is placed in the subfamily Elcaninae

Handlirsch, 1906. The wing venation of the new genus is similar to another Elcaninae genus *Ellca* Kočárek, 2020, suggesting a close phylogenetic relationship between the two genera. *Adelphellca* gen. nov. differs from *Ellca* in the type of metatibial spurs, which are spine-like in *Ellca* and leaf-like in *Adelphellca*. The wing features of another previously described species of Elcaninae, *Probaisselcana zhengi* Gu et al., 2022, show a strong resemblance to the wing features of the new genus. This species differs from *Ellca* in a differently shaped ovipositor (Gu et al. 2022). Since the ovipositor of *Adelphellca simplicissima* is unknown, it is suggested that *P. zhengi* be placed in *Adelphellca*. *Probaisselcana zhengi* differs from the other *Probaisselcana* species in having a much longer anal margin between CuA + CuPaα and MP, a feature common in all known species of Burmese amber Elcanidae, suggesting that the species found in this material do not belong to well-established genera *Probaisselcana* or *Panorpidium* Westwood, 1854.

Genus *Kolymbelcana* gen. nov.

https://zoobank.org/3E53CAAC-43C3-40A0-AF45-F2F4D9E040B1

Type species.—*Kolymbelcana phantasma* sp. nov.

Etymology.—The genus name derives from the ancient Greek term "kolymbao" (dive). It is associated with the hypothesized aquatic affinity of some Elcanidae species.

Diagnosis.—Forewing with two branches of M between CuA + CuPaα and the stem of RP. Anal margin between CuA + CuPaα making up 22% of total wing length. RP with 11 branches. Pterostigma dark without cross veins. Metatibial spurs leaf-like. Ovipositor sword shaped. Conspicuous wing markings consisting of two prominent darkly colored spots and a broad distal wing margin.

Kolymbelcana phantasma sp. nov.

https://zoobank.org/DC4F9DCF-832F-47E7-AD1F-0D549491A2B9

Fig. 2

Etymology.—From Latin "phantasma" meaning "ghost" or "phantom." The species' name recognizes the peculiar state of preservation of this specimen in which one side is dark black with a whitish glimmer where the body cuts the amber.).

Locality and horizon.—The specimen was included in amber found in Hkamti, Sagaing Division, Myanmar or Tanai, Kachin State Burma, Myanmar, two nearby amber mining locations. The amber from Hkamti is ca. 110 My and the amber from Tanai ca. 99 My old.

Holotype.—Female, deposited at the LIB Hamburg (accession number GPIH07020). The amber holding this specimen includes several Diptera as syninclusions.

Diagnosis.—The species can be recognized by the following combination of features: forewings 9.5 mm long, with two dark spots, the anterior being approximately double the diameter of the posterior. Dark colored wing margin with some space between posterior margin and the distal end of wing. Metafemur slightly longer than metatibia (5.8 mm and 5.4 mm, respectively). Metatibial spurs leaf-like. Proximal metatibial spur spine-like, about 1/3 the size of main spurs. At least one apical metatibial spur spine-like and approximately the same length as main spurs. Metabasitarsus 1.5 mm long, ventrally with a row of rather prominent denticles and at least two apically pointed apical spines. Ovipositor sword-like, at least 3.3 mm long (tip may be missing).

Description.—Female. Entire body preserved (with some parts broken off/dislocated in the amber piece), yet only certain parts visible

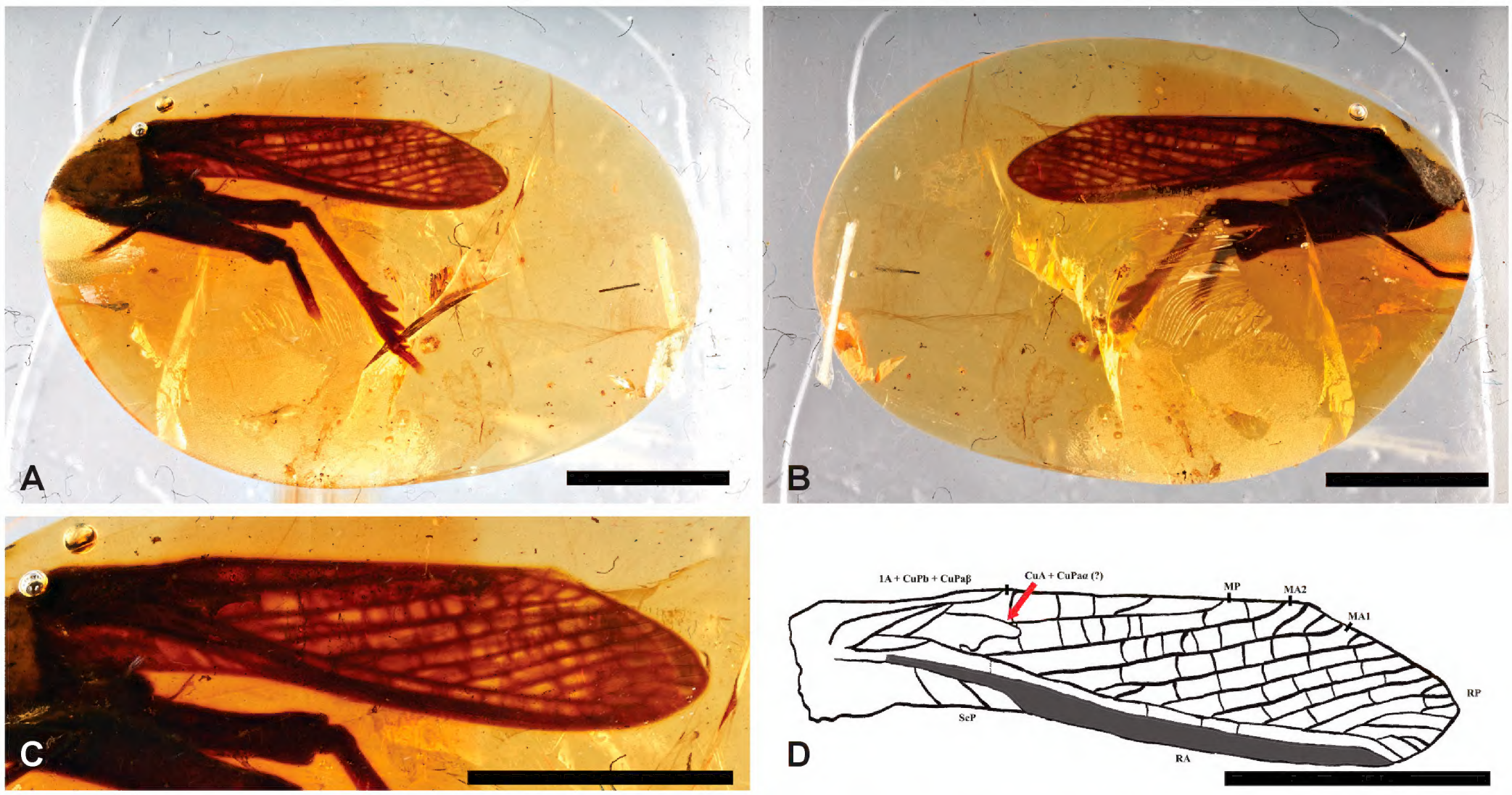

Fig. 1. *Adelphellca simplicissima* gen. et sp. nov. GPIH_07019. **A, B.** Left and right view of the specimen, respectively. **C, D.** Forewing and interpretative drawing of the former, respectively. The red arrow marks a peculiar structure seen in the image of the forewing of which the identity is doubtful. It is interpreted in D as a deformed (possibly during preservation) CuA + CuPaα. Scale bars: 5 mm.

due to the animal's position in the amber piece. Visible parts include forewing, mesothoracic leg, metathoracic leg, abdomen including ovipositor. The silhouette of the head capsule, some mouthparts, and first part of one antenna can be seen; however, no distinct characteristics can be distinguished from the visible parts. The amber piece holding this specimen includes several syninclusions of dipterans of up to 2.6 mm body length with exquisite details.

Forewing: 9.5 mm long. 1A + CuPb + CuPaβ fused. CuA + CuPaα rather narrow. M with three branches, two of which are between CuA + CuPaα and the stem of RP. Anal margin between CuA + CuPaα making up 22% of total wing length. RP with 11 branches. ScP with five cross veins, ScA with four, and CP with 7. Pterostigma dark and sclerotized, without cross veins. The forewings show conspicuous markings consisting of two dark spots, the anterior of which is significantly larger than the posterior (1.3 mm vs. 0.6 mm in diameter) and a darkly colored wing margin up to 1.5 mm broad and not extending all the way to the tip of the forewing.

Mesothoracic leg: Mesotibia 3.5 mm long. Many short setae dorsally, either very stiff setae or small spines ventrally. At the apical end, crown of presumably 4 (three are visible) denticles with one located at each corner. First segment of mesotarsus 2.7 mm long with row of very small setae dorsally and row of much more prominent stiff setae ventrally. Apical end of first mesotarsal segment with a pointed spine. Dislocated part of the animal in the amber piece is second and third tarsal segment of one leg. We suggest that this part may belong to the mesothoracic leg. Second tarsal segment 1.1 mm long, third tarsal segment 1.0 mm long (including claws). Both segments bearing setae that are more numerous ventrally. Third tarsal segment ending in two curved prominent claws.

Metathoracic leg: Metafemur 5.8 mm long. Metatibia 5.4 mm long. First half of metatibia dorsally with small denticles followed by a proximal spine of approximately triple the size of denticles. Proximal spine followed by main metatibial spurs approximately triple the size of the proximal spur and leaf-like in shape. Metatibia apically with one long spine (about the size of main spurs) pointing orthogonally from metatibia. Ventrally with an apical spine-like lobe featuring small denticles. Metabasitarsus 1.5 mm long; ventrally with at least 5 denticles, dorsally with short setae. Apically with at least two spines, pointing apically. Second tarsal segment short; third tarsal segment about half the size of basitarsus, featuring curved claws.

Abdomen: Nine tergites visible. Cercus partly visible, likely one-segmented. Ovipositor sword-like, at least 3.3 mm long (unsure whether tip is broken off as is commonly the case with this type of ovipositor in amber).

Remarks.—The new genus is similar to *Probaisselcana* Gorochov, 1989, *Pseudoprobaisselcana* Schall et al., 2024, *Minelcana* Gorochov et al., 2006, *Ellca* Kocàrek, 2020 and *Adelphellca* gen. nov. in having two branches of M between CuA + CuPaα and the stem of RP. However, it differs from the first three genera mentioned by featuring a pterostigma without cross veins. It further differs from *Ellca* and presumably *Adelphellca* in the type of ovipositor, which is sword-like in the new genus and scythe-like in the other two (based on the reassigned *A. zhengi* (Gu et al. 2022)) as well as in

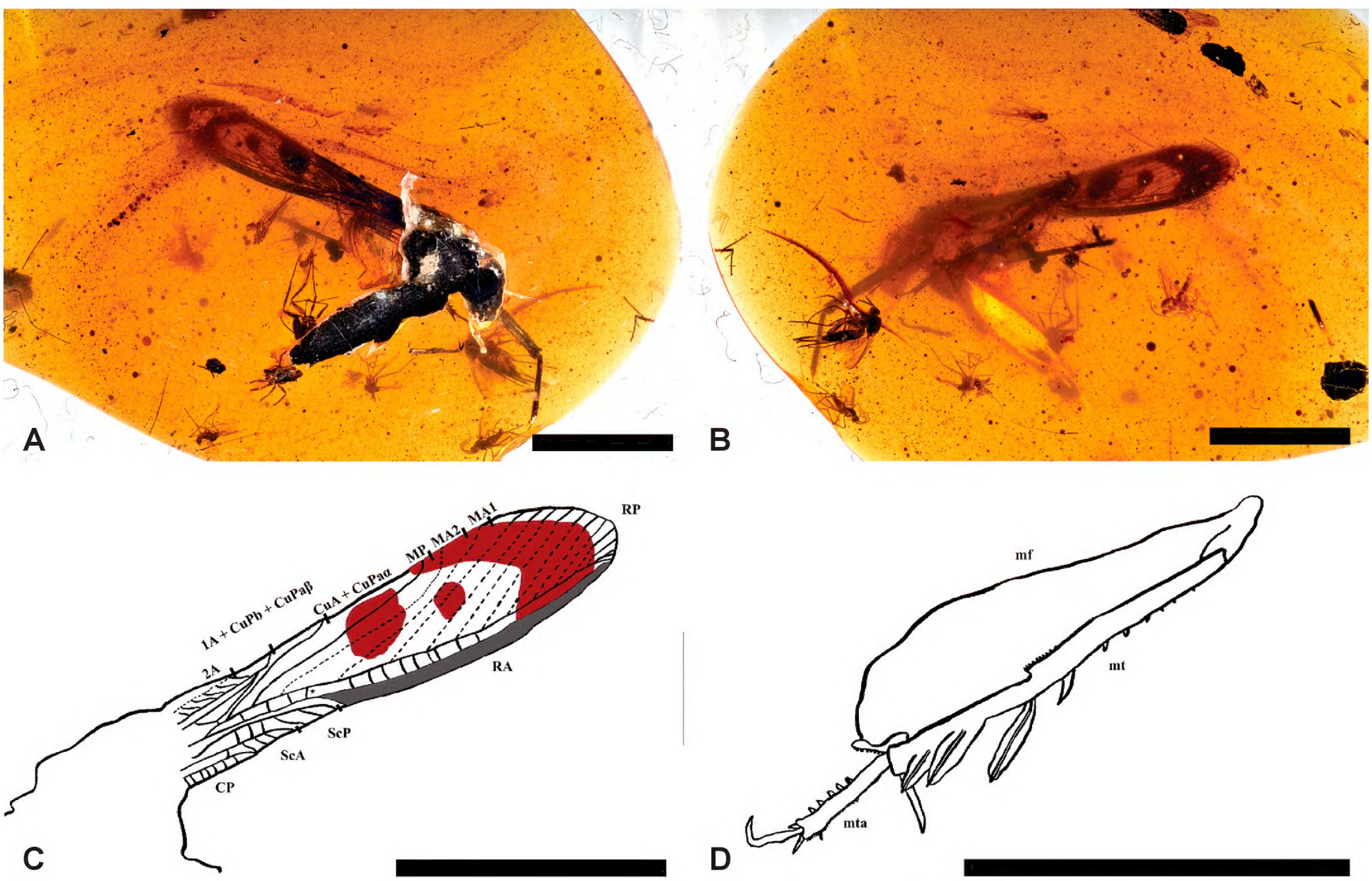

Fig. 2. *Kolymbelcana phantasma* gen. et sp. nov. GPIH_07020. **A, B.** Right and left view of the specimen, respectively. Note the peculiar imprint the specimen forms in **A,** which inspired the species' epithet. **C.** Interpretative drawing of the forewing. Small black star marks the position of the stem of RP. **D.** Interpretative drawing of the left metathoracic leg. Abbreviations: mf = metafemur; mt = metatibia; mta = metatarsus. Scale bars: 5 mm.

the two wing spots and the colored wing margin, neither of which are present in *Ellca* or *Adelphellca*. It is additionally separated from *Ellca* in the type of metatibial spurs, which are spine-like in *Ellca* but leaf-like in *Kolymbelcana*. *Kolymbelcana* has 11 branches of RP, which is an amount currently surpassed in Elcanidae only by *Letoelcana* Schall et al., 2023, which has 14 branches of RP. *Letoelcana* differs from *Kolymbelcana* by featuring three branches of M between CuA + CuPaα and the stem of RP.

Discussion

We here describe two new genera and species of Burmese amber Elcanidae *Adelphellca simplissica* gen. et sp. nov. and *Kolymbelcana phantasma* gen. et sp. nov. The forewing venation feature of fused 1A + CuPb + CuPaβ places both new species in the subfamily Elcaninae Handlirsch, 1906. Among the previously described species of Burmese amber Elcaninae, they are both closest to *Ellca nevelka* Kočárek, 2020 and *Probaisselcana zhengi* Gu et al., 2022 based on the two branches of M between CuA + CuPaα and the stem of RP as well as a pterostigma without cross veins. *Adelphellca* differs from *Ellca* in the type of metatibial spurs; however, due to its similarity to the latter genus, a close phylogenetic relationship between the two genera is possible. *Probaisselcana zhengi* does not differ from *Adelphellca* in any character known; however, it differs from the other species of *Probaisselcana* Gorochov, 1989 by having a much longer anal margin between CuA + CuPaα and MP. Therefore, we suggest that *P. zhengi* be moved to *Adelphellca*. *Kolymbelcana* gen. nov. shares a similar wing venation morphology to *Adelphellca*; however, based on the inclusion of former *P. zhengi* in that genus, *Kolymbelcana* differs from *Adelphellca* in the type of ovipositor (sword-shaped in the former, scythe-shaped in the latter (Gu et al. 2022)), suggesting a different site of oviposition and possibly a different habitat preference (Zhou et al. 2024).

Conclusions

Adelphellca simplicissima gen. et sp. nov. and *Kolymbelcana phantasma* gen. et sp. nov. are described from mid-Cretaceous Burmese amber and assigned to the subfamily Elcaninae Handlirsch, 1906 based on both having 1A + CuPb + CuPaβ of the forewing fused. *Probaisselcana zhengi* Gu et al., 2022 is moved to the new genus *Adelphellca*. These new additions to Burmese amber Elcanidae increase the diversity of the family to 15 genera and 19 species.

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